UC GEOHEALTH LABORATORY

Using GIS to assess the impact of childhood environments on obesity

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Aims and Objectives

Aim

- To examine the relationship between environmental exposure near the school, home and 'route'; and health outcomes among children

Objectives

- To undertake a national analysis of childhood obesity using the NZ health survey
- Identify the exposure of school children to obesity based on the characteristics of the food and physical environments in Hamilton
- To relate obesogenic environment and health among Hamilton children

Background

- Childhood Obesity
  - Obesity is a major global public health issue
- Childhood Obesity in New Zealand
  - *"One-third of children are overweight or obese; 11 percent are obese in 2011-13."* (NZHS. 2015).
- Obesogenic Environments
  - *"Obesity is a normal response to an abnormal environment"* (Weight Management Centre, 2010)
- Applications of GIS in Public Health
  - Processing, analysing and interpreting spatial and geographical data

Food Environment vs Physical Environment

- Access of food sources within a given community
- Obesogenic Food Environment characteristics:
  - High number of fast food outlets (Toxic food environment)
  - Low number of healthy food outlets

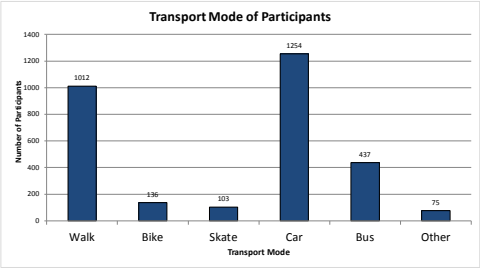
- Built and physical aspects of the environment, which influences how people interact within their environment
- Obesogenic Physical Environment characteristics:
  - Lack of accessibility to physical exercise
  - Lack of recreational grounds and parks
  - Lack of active transport infrastructure (walkability and cyclability)

- Typically in areas of high social and economic deprivation

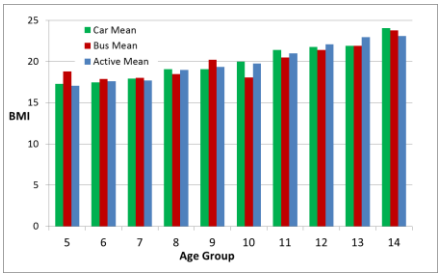
Nationwide Analysis

- New Zealand Health Survey (NZHS) children aged 5-14. (n=2404)
- NZHS data variables : Age, Ethnicity, Social Deprivation, Nutrition, Mode of Transport, Food Security, Body Mass Index (BMI)
- Relationship between NZHS data variables and BMI
- Nationwide Regression Analysis between BMI and Active Transport

Transport mode



BMI, age and mode

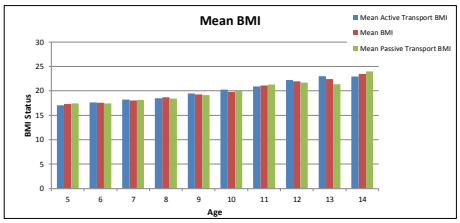


BMI vs Mode of Transport

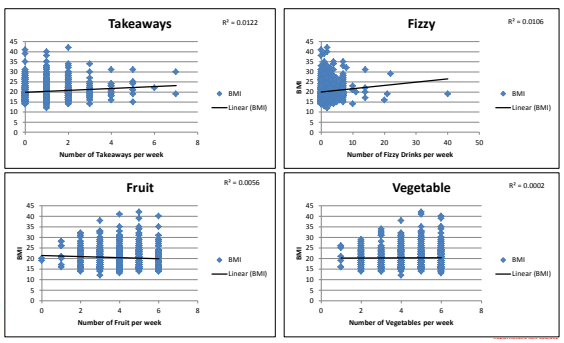
Model	Unstandardized Coefficients		Standardized Coefficients	Sig.	95.0% Confidence Interval for B	
	Beta	Std. Error	Beta		Lower Bound	Upper Bound
Walk	.468	.200	.048	.019	.076	.860
Bike	.842	.427	.040	.049	.005	1.679
Skate	-1.372	.487	-.057	.005	-2.326	-.418
Car	-1.011	.197	-.104	.000	-1.396	-.626
Bus	1.059	.255	.084	.000	.559	1.559

Active vs passive transport

- Exclusively active vs exclusively passive transport



Nutrition vs BMI

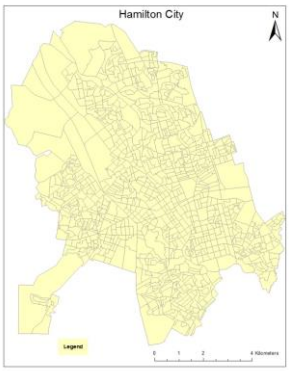


Hamilton City Analysis

- North Island
- NZ's 4th most populated city, 150,000
  - 69.5% Pākehā/European
  - 21.3% Māori
  - 13.8% Asian
  - 5.1% Pacific Peoples
  - 2.0% Other
- Dairy farming
- Chiefs (Rugby) and WBOP Magic (Netball)
- Hamilton identified as an area of obesity concern

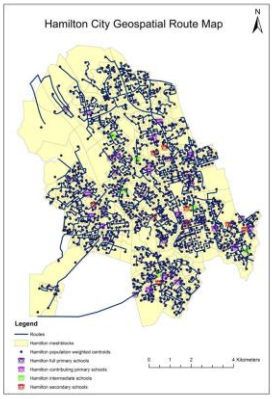
Hamilton City Analysis

- Geospatial Analysis of obesogenic environments
- NZHS children aged 5-14 (N=70)
- NZHS data variables : Age, Ethnicity, Social Deprivation, Nutrition, Mode of Transport, Food Security, Body Mass Index (BMI)
- Exposure to obesogenic (& non-) environment and BMI
- BMI and Transport Mode



- Hamilton City Boundary Map
- Identify NZHS participants aged 5-14

- Food Environment
  - Takeaways
  - Deli/Eating houses
  - Dairies
  - Bakeries
- Physical Environment
  - Green space



Network Route Analysis

- Closest Facility Network
  - Schools
  - Pop weighted Centroids
- Match the NZHS child to the nearest age/gender appropriate school

<u>Neighbourhood Environment – Home and School Buffer</u>

- 5- 14 NZ Health Survey Meshblocks
- Full Primary School and home
- 200m Buffer Zone round both

<u>Neighbourhood Environment – Route Buffer</u>

- Food environment vs Physical environment
- 200 metre buffer round school & home
- 30 metre buffer round route
- 100 metre buffer round route
- Non obesogenic environment

Neighbourhood Environment

- Food environment vs Physical environment
- Closest Facility Network Analysis
- 30 metre buffer zone
- 100 metre buffer zone
- Obesogenic environment

Hamilton City Geospatial analysis results

- Food environment = the number of fast food outlets within the participants route buffer
- Physical environment= the amount of greenspace within the participants route buffer

BMI vs Environment

Regression Analysis: BMI and **Food** Environment

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.130[a]	.017	.002	4.12

a. Predictors: (Constant), ObesogenicEnvironment30m

Regression Analysis: BMI and **Physical** Environment

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.117[a]	.014	-.001	4.12

a. Predictors: (Constant), VAR00001

No statistical significance – low R Squared values

Transport Mode vs Food Environment

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Walk	.115[a]	.013	-.001	2.875
Bike	.075[a]	.006	-.009	2.886
Skate	.149[a]	.022	.008	2.862
Car	.169[a]	.028	.014	2.852
Bus	.119[a]	.014	.000	2.873

	Unstandardized Coefficients		Standardized Coefficients	
	Beta	Std. Error	BetaModel	Sig.
Walk	-.657	.687	-.115	.342
Bike	-1.050	1.703	-.075	.540
Skate	-2.095	1.689	-.149	.219
Car	.962	.682	.169	.163
Bus	.967	.981	.119	.328

Key Findings

- No significant connection between a participants environment and BMI status
- Mode of transport does not have a significant bearing on BMI status
- Social Indicators are far more effective at predicting BMI status (Social Deprivation)

Limitations

- Geospatial assumptions about NZHS participants – most likely route to school.
- Hamilton City – small sample size

Conclusion

- No connection found between obesogenic environments and increased BMI status
- Use of GIS to develop a method for estimating home, school and journey to school environmental exposure

Questions